A NEW COMBINATION WEDGE FOR USE WITH THE PETROGRAPHICAL MICROSCOPE.

THREE different methods are at present in general use for determining the optical character of a mineral with the petrographical microscope. The first of these employs a quarter-mica undulation mica-plate, the second a selenite plate showing the interference color, red of the first order, and the third a quartz wedge whose interference colors run from gray of the first order to red of the third (Newton's color scale).

The underlying principle of these three methods is the same. For the examination of the optical interference figures in convergent light they answer their purpose well, but for the determination of the optical character of minerals in parallel polarized light they all exhibit one common failing. On inserting any one of them into the tube of the microscope the interference color of the mineral in the slide rises or falls abruptly to some other interference color of the color scale. This jump of the interference color, due to the sudden change of the distance between the two rays passing through the crystal, and caused by the insertion of the plate or thin edge of the quartz wedge, which in itself is so thick that it alone shows gray of the first order, is often sufficient to render the determination uncertain. In deeply colored minerals (in certain amphiboles and pyroxenes) this is particularly noticeable, for there the natural color of the mineral hides the interference color to a great extent. On inserting the plate or wedge, one observes a change of color in the mineral, but is often unable to distinguish whether the color has risen or fallen.

This fault is easily remedied by combining a quartz (or selenite) wedge which shows gray first order to red third order, and in which the ray vibrating parallel to the long direction of the wedge has the greater velocity ($\mathfrak{a}$) with a selenite plate

showing green of the second order, in which, however, the ray vibrating parallel to the long direction has the lesser velocity ($\mathfrak{c}$). These two plates are cemented one above the other between glass plates (Fig. 1, cross section. Vertical scale exaggerated.)

With this arrangement the central part of the wedge (Fig. 1, A) appears dark between crossed Nicols as the effect of the quartz wedge on the light passing through at that point is exactly compensated by the selenite plate. To the right and left of A, however, the interference colors rise from dark to

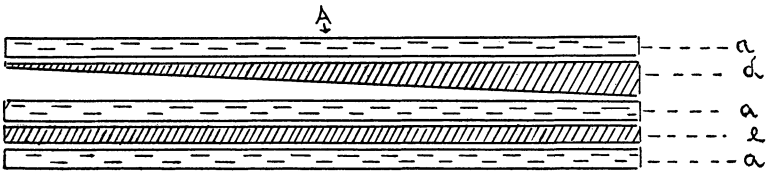

FIG. 1.

blue of the second order at the two ends. This wedge has therefore no noticeable effect on the rays passing through it at the center (Fig. 1, A). The interference color of the mineral seen through the wedge at this point will be the same as though no wedge were there. If, however, the wedge is pulled out or pushed in, the interference color of the mineral either rises or falls, but with a gradual transition from one color to another without an abrupt rise or fall of the color at the start.

Near the center of the wedge is a point for which the difference between the two rays is $\frac{1}{4}\lambda$. This part of the wedge can therefore take the place of the quarter undulation plate.

To make the combination wedge as useful as possible, it was fitted in a metal frame of the same outer dimensions as the ordinary wedge, and with it in the same frame a short selenite plate, red first order, is placed at one end. A space is left free, and is thrown into the field when the wedge is not in use. To steady the motion of the wedge, and also to mark the position of the open space, a small steel spring is screwed onto the tube

above the objective. The small rounded tip at the end of the spring presses up against the metallic rim of the wedge, and at the point where the space is in the center of the field snaps into a small pit made in the rim for the purpose.

The weak point of the ordinary wedges, that the interference colors rise or fall abruptly on their insertion, is thus remedied, and the three plates, quarter-undulation plate, red first order, and wedge are united to one wedge which remains in its place on the microscope, and which it is not necessary to remove after each determination.[1]

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[1] The above wedge was first described in a footnote, p. 275, of "Die foyaitisch-theralitischen Eruptivgesteine der Insel Cabo Frio, Rio de Janeiro, Brasilien," von Fred Eugene Wright," TSCHERMAK'S *Minerolog. petrogr. Mittheilungen.* Bd. XX, pp. 233–306. The combination wedge is made by Voigt & Hochgesang, Göttingen, Germany. Price, 21 M. (*ca.* $5 if quartz be used. [The wedge can also be obtained from Bausch & Lomb.] The price is still less if selenite be substituted for quartz). In ordering, the dimensions of the aperture into which the wedge is to be inserted should be given, also whether the wedge is inserted into the microscope tube parallel to the horizontal cross hair, or at an angle of 45° with same.